General

Title

Coronary artery bypass graft (CABG): hospital 30-day, all-cause risk-standardized mortality rate (RSMR) following isolated CABG surgery.

Source(s)

Yale New Haven Health Services Corporation (YNHHSC), Center for Outcomes Research and Evaluation (CORE). 2017 procedure-specific measure updates and specifications report: hospital-level 30-day risk-standardized mortality measure. Baltimore (MD): Centers for Medicare & Medicaid Services (CMS); 2017 Mar. 46 p. [9 references]

Measure Domain

Primary Measure Domain

Clinical Quality Measures: Outcome

Secondary Measure Domain

Does not apply to this measure

Brief Abstract

Description

This measure estimates a hospital-level, 30-day risk-standardized mortality rate (RSMR) for patients discharged from the hospital following isolated coronary artery bypass graft (CABG) surgery. Mortality is defined as death from any cause within 30 days of the procedure date.

The Centers for Medicare & Medicaid Services (CMS) annually reports the measure for individuals who are 65 years and older and are Medicare Fee-for-Service (FFS) beneficiaries hospitalized in non-federal short-term acute care hospitals (including Indian Health Services hospitals) and critical access hospitals.

Rationale

Outcome measures can focus attention on a broad set of healthcare activities that affect patients' well-being. Moreover, improving patient outcomes is the ultimate goal of quality improvement, so outcomes

are a direct measure of success in quality improvement. Two statutes direct the Department of Health and Human Services to develop outcomes measures. The Deficit Reduction Act (DRA) of 2005 mandated that the Secretary of Health and Human Services publicly report quality measures that include measures of hospital outcomes and efficiency under the Hospital Inpatient Quality Reporting (IQR) Program (formerly the Reporting Hospital Quality Data for Annual Payment Update Program). In addition, the Affordable Care Act of 2010 promotes the further development and use of outcomes measures.

The goal of outcomes measurement is to evaluate patient outcomes after accounting for patients' conditions at the time of hospital admission (hospital case-mix). This mortality measure was developed to identify hospitals that perform better or worse than would be expected based on their patient case-mix, and therefore to promote hospital quality improvement and better inform consumers about quality of care.

Evidence for Rationale

Yale New Haven Health Services Corporation (YNHHSC), Center for Outcomes Research & Evaluation (CORE). Hospital-level 30-day all-cause mortality following coronary artery bypass graft surgery: updated measure methodology report. Baltimore (MD): Centers for Medicare & Medicaid Services (CMS); 2014 Jun 6. 101 p. [8 references]

Primary Health Components

Coronary artery bypass graft (CABG); 30-day mortality rate

Denominator Description

The measure cohort consists of admissions for Medicare Fee-for-Service (FFS) beneficiaries aged 65 years or older and discharged from non-federal acute care hospitals and critical access hospitals, having a qualifying isolated coronary artery bypass graft (CABG) surgery during the index admission.

The risk-standardized mortality rate (RSMR) is calculated as the ratio of the number of "predicted" deaths to the number of "expected" deaths at a given hospital, multiplied by the national observed mortality rate. For each hospital, the denominator is the number of deaths expected based on the nation's performance with that hospital's case mix.

See the related "Denominator Inclusions/Exclusions" field.

Note: This outcome measure does not have a traditional numerator and denominator like a core process measure; thus, this field is used to define the measure cohort.

See the *2017 Procedure-specific Measure Updates and Specifications Report. Hospital-level 30-day Risk-standardized Mortality Measure* for more details.

Numerator Description

The measure counts death from any cause within 30 days of the procedure date.

The risk-standardized mortality rate (RSMR) is calculated as the ratio of the number of "predicted" deaths to the number of "expected" deaths at a given hospital, multiplied by the national observed mortality rate. For each hospital, the numerator of the ratio is the number of deaths within 30 days predicted based on the hospital's performance with its observed case mix.

Note: This outcome measure does not have a traditional numerator and denominator like a core process measure; thus, this field is used to define the outcome.

See the *2017 Procedure-specific Measure Updates and Specifications Report. Hospital-level 30-day Risk-standardized Mortality Measure* for more details.

Evidence Supporting the Measure

Type of Evidence Supporting the Criterion of Quality for the Measure

One or more research studies published in a National Library of Medicine (NLM) indexed, peer-reviewed journal

Additional Information Supporting Need for the Measure

- Coronary artery bypass graft (CABG) is a priority area for outcomes measure development because it is a common procedure associated with considerable morbidity, mortality, and health care spending. In 2007, there were 114,028 hospitalizations for CABG surgery and 137,721 hospitalizations for combined surgeries for CABG and valve procedures ("CABG plus valve" surgeries) among Medicare Fee-for-Service (FFS) patients in the United States (Drye et al., 2009).
- CABG surgeries are costly procedures that account for the majority of major cardiac surgeries performed nationally. In fiscal year 2009, isolated CABG surgeries accounted for almost half (47.6%) of all cardiac surgery hospital admissions in Massachusetts (Massachusetts Data Analysis Center, 2011). In 2008, the average Medicare payment was $30,546 for CABG without valve and $47,669 for CABG plus valve surgeries (Pennsylvania Health Care Cost Containment Council [PCH4], 2011).
- Mortality rates following CABG surgery vary across hospitals. The unadjusted mean hospital mortality rate in the January 2009 to September 2011 sample of Medicare FFS patients undergoing isolated CABG surgery is 3.7% and ranges from 0% to 100% with a median of 2.9% (25th and 75th percentiles are 1.5% and 4.8%, respectively). The variation persists after risk adjustment. The mean risk-standardized mortality rate (RSMR) is 3.3% with a range from 1.5% to 9.3%. The median risk-standardized mortality rate is 3.1% (25th and 75th percentiles are 2.7% and 3.7%, respectively). Similarly, published data also demonstrate variation in mortality rates. The observed operative (i.e., in-hospital or within 30-days of surgery) all-cause, hospital-level mortality rate was 1.81% and ranged from 0.0% to 5.6% among patients who were discharged after CABG surgery (without any other major heart surgery) in New York in 2008 (New York State Department of Health, 2010).

Evidence for Additional Information Supporting Need for the Measure

Drye E, Krumholz H, Vellanky S, Wang Y. Probing new conditions and procedures for new measure development. New Haven (CT): Yale New Haven Health Systems Corporation; Center for Outcomes Research and Evaluation; 2009. 7 p.

Massachusetts Data Analysis Center. Adult coronary artery bypass graft surgery in the commonwealth of Massachusetts. Fiscal year 2009 report (October 1, 2008 through September 20, 2009). Hospital and surgeon risk-standardized 30-day mortality rates. Boston (MA): Massachusetts Department of Public Health; 2011 Jan. 77 p.

New York State Department of Health. Adult cardiac surgery in New York State 2006-2008. Albany (NY): New York State Department of Health; 2010 Dec. 54 p.

Pennsylvania Health Care Cost Containment Council (PCH4). Cardiac surgery in Pennsylvania 2008-2009. Harrisburg (PA): Pennsylvania Health Care Cost Containment Council (PCH4); 2011 May. 60 p.

Yale New Haven Health Services Corporation (YNHHSC), Center for Outcomes Research & Evaluation (CORE). Hospital-level 30-day all-cause mortality following coronary artery bypass graft surgery: updated measure methodology report. Baltimore (MD): Centers for Medicare & Medicaid Services (CMS); 2014 Jun 6. 101 p. [8 references]

Extent of Measure Testing

Assessment of Updated Model

The coronary artery bypass graft (CABG) surgery mortality measure estimates hospital-specific 30-day all-cause risk-standardized mortality rates (RSMRs) using a hierarchical logistic regression model. Refer to Section 2 for a summary of the measure methodology and model risk-adjustment variables. Refer to prior methodology and technical reports for further details.

The Centers for Medicare & Medicaid Services (CMS) evaluated and validated the performance of the model using the July 2013 to June 2016 data for the 2017 public reporting period. They also evaluated the stability of the risk-adjustment model over the three-year measurement period by examining the model variable frequencies, model coefficients, and the performance of the risk-adjustment model in each year.

CMS assessed logistic regression model performance in terms of discriminant ability for each year of data and for the three-year combined period. They computed two summary statistics to assess model performance: the predictive ability and the area under the receiver operating characteristic (ROC) curve (c-statistic). CMS also computed between-hospital variance for each year of data and for the three-year combined period. If there were no systematic differences between hospitals, the between-hospital variance would be zero.

The results of these analyses are presented in Section 4.2 of the original measure documentation.

CABG Surgery Mortality 2017 Model Results

Frequency of CABG Surgery Model Variables

CMS examined the change in the frequencies of clinical and demographic variables. Frequencies of model variables were stable over the measurement period. The largest changes in the frequencies (those greater than 2% absolute change) include:

- An increase in Renal failure (27.6% to 29.7%)
- Decreases in Angina; old myocardial infarction (42.4% to 37.7%) and Unstable angina and other acute ischemic heart disease (42.3% to 35.7%)

CABG Surgery Model Parameters and Performance

Table 4.2.2 in the original measure documentation shows hierarchical logistic regression model variable coefficients by individual year and for the combined three-year dataset. Table 4.2.3 in the original measure documentation shows the risk-adjusted odds ratios (ORs) and 95% confidence intervals for the CABG surgery mortality model by individual year and for the combined three-year dataset. Overall, the variable effect sizes were relatively constant across years. In addition, model performance was stable over the three-year time period; the c-statistic increased slightly from 0.77 to 0.78.

Refer to the original measure documentation for additional information.

Evidence for Extent of Measure Testing

Yale New Haven Health Services Corporation (YNHHSC), Center for Outcomes Research and Evaluation (CORE). 2017 procedure-specific measure updates and specifications report: hospital-level 30-day risk-standardized mortality measure. Baltimore (MD): Centers for Medicare & Medicaid Services (CMS); 2017 Mar. 46 p. [9 references]

State of Use of the Measure

State of Use

Current routine use

Current Use

not defined yet

Application of the Measure in its Current Use

Measurement Setting

Hospital Inpatient

Professionals Involved in Delivery of Health Services

not defined yet

Least Aggregated Level of Services Delivery Addressed

Single Health Care Delivery or Public Health Organizations

Statement of Acceptable Minimum Sample Size

Specified

Target Population Age

Age greater than or equal to 65 years

Target Population Gender

Either male or female

National Strategy for Quality Improvement in Health Care

National Quality Strategy Aim

Better Care

National Quality Strategy Priority

Making Care Safer

Institute of Medicine (IOM) National Health Care Quality

Report Categories

IOM Care Need

Getting Better

IOM Domain

Safety

Data Collection for the Measure

Case Finding Period

Discharges between July 1, 2013 and June 30, 2016

Denominator Sampling Frame

Patients associated with provider

Denominator (Index) Event or Characteristic

Institutionalization

Patient/Individual (Consumer) Characteristic

Therapeutic Intervention

Denominator Time Window

not defined yet

Denominator Inclusions/Exclusions

Inclusions
An *index admission* is the hospitalization to which the mortality outcome is attributed and includes admissions for patients:

> Having a qualifying isolated coronary artery bypass graft (CABG) surgery* during the index admission
> Enrolled in Medicare Fee-for-Service (FFS) Part A and Part B for the 12 months prior to the date of admission, and enrolled in Part A during the index admission
> Aged 65 or over

Isolated CABG surgeries are defined as those CABG procedures performed *without* the following concomitant valve or other major cardiac, vascular, or thoracic procedures:

> Valve procedures;
> Atrial and/or ventricular septal defects;
> Congenital anomalies;
> Other open cardiac procedures;

Heart transplants;
Aorta or other non-cardiac arterial bypass procedures;
Head, neck, intracranial vascular procedures; and
Other chest and thoracic procedures.

*International Classification of Diseases, Tenth Revision, Procedure Coding System (ICD-10-PCS) codes used to identify eligible CABG procedures in claims for discharges on or after October 1, 2015 are listed in the original measure documentation. International Classification of Diseases, Ninth Revision (ICD-9) code lists for discharges prior to October 1, 2015 can be found in the *2016 Procedure-specific Mortality Measures Updates and Specifications Report*.

Exclusions
The CABG surgery mortality measure excludes index admissions for patients:

With inconsistent or unknown vital status or other unreliable demographic (age and gender) data
Discharged against medical advice
With subsequent qualifying CABG procedures during the measurement period

Exclusions/Exceptions

not defined yet

Numerator Inclusions/Exclusions

Inclusions
The measure counts death from any cause within 30 days of the procedure date.

The risk-standardized mortality rate (RSMR) is calculated as the ratio of the number of "predicted" deaths to the number of "expected" deaths at a given hospital, multiplied by the national observed mortality rate. For each hospital, the numerator of the ratio is the number of deaths within 30 days predicted based on the hospital's performance with its observed case mix.

Note: This outcome measure does not have a traditional numerator and denominator like a core process measure; thus, this field is used to define the outcome.

See the *2017 Procedure-specific Measure Updates and Specifications Report. Hospital-level 30-day Risk-standardized Mortality Measure* for more details.

Exclusions
Unspecified

Numerator Search Strategy

Institutionalization

Data Source

Administrative clinical data

Type of Health State

Death

Instruments Used and/or Associated with the Measure

None

Computation of the Measure

Measure Specifies Disaggregation

Does not apply to this measure

Scoring

Rate/Proportion

Interpretation of Score

Desired value is a lower score

Allowance for Patient or Population Factors

not defined yet

Description of Allowance for Patient or Population Factors

Risk-Adjustment Variables

In order to account for differences in case mix among hospitals, the measure adjusts for variables (for example, age, sex, comorbid diseases, and indicators of patient frailty) that are clinically relevant and have relationships with the outcome. For each patient, risk-adjustment variables are obtained from inpatient, outpatient, and physician Medicare administrative claims data extending 12 months prior to, and including, the index admission.

The measure adjusts for case mix differences among hospitals based on the clinical status of the patient at the time of the index admission. Accordingly, only comorbidities that convey information about the patient at that time or in the 12 months prior, and not complications that arise during the course of the hospitalization, are included in the risk adjustment.

The measure does not adjust for socioeconomic status (SES) because the association between SES and health outcomes can be due, in part, to differences in the quality of health care that groups of patients with varying SES receive. The intent is for the measure to adjust for patient demographic and clinical characteristics while illuminating important quality differences.

Refer to Appendix D of the original measure documentation for the list of comorbidity risk-adjustment variables and the list of complications that are excluded from risk adjustment if they occur only during the index admission.

Standard of Comparison

not defined yet

Identifying Information

Original Title

Hospital-level 30-day RSMR following CABG surgery.

Measure Collection Name

National Hospital Inpatient Quality Measures

Measure Set Name

Mortality Measures

Submitter

Centers for Medicare & Medicaid Services - Federal Government Agency [U.S.]

Developer

Centers for Medicare & Medicaid Services - Federal Government Agency [U.S.]

Yale-New Haven Health Services Corporation/Center for Outcomes Research and Evaluation under contract to Centers for Medicare & Medicaid Services - Academic Affiliated Research Institute

Funding Source(s)

Center for Medicare & Medicaid Services (CMS)

Composition of the Group that Developed the Measure

This measure was developed by a team of clinical and statistical experts:

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Financial Disclosures/Other Potential Conflicts of Interest

None

Endorser

National Quality Forum - None

NQF Number

not defined yet

Date of Endorsement

2014 Nov 12

Core Quality Measures

Cardiology

Measure Initiative(s)

Hospital Compare

Hospital Inpatient Quality Reporting Program

Adaptation

This measure was not adapted from another source.

Date of Most Current Version in NQMC

2017 Mar

Measure Maintenance

Annual

Date of Next Anticipated Revision

2018 Apr

Measure Status

This is the current release of the measure.

This measure updates a previous version: Specifications manual for national hospital inpatient quality measures, version 5.0b. Centers for Medicare & Medicaid Services (CMS), The Joint Commission; Effective 2015 Oct 1. various p.

Measure Availability

Source available from the QualityNet Web site .

Check the QualityNet Web site regularly for the most recent version of the specifications manual and for the applicable dates of discharge.

Companion Documents

The following are available:

Hospital compare: a quality tool provided by Medicare. [internet]. Washington (DC): U.S. Department of Health and Human Services; [accessed 2017 Oct 3]. This is available from the Medicare Web site .

Yale New Haven Health Services Corporation (YNHHSC), Center for Outcomes Research and Evaluation (CORE). 2017 Medicare hospital quality chartbook. Baltimore (MD): Centers for Medicare & Medicaid Services (CMS); 2017. Available from the Centers for Medicare & Medicaid Services (CMS) Web site .

Yale New Haven Health Services Corporation (YNHHSC), Center for Outcomes Research and Evaluation (CORE). 2017 procedure-specific mortality measure updates and specifications report: supplemental ICD-10 code lists for use with claims for discharges on or after October 1, 2015. Baltimore (MD): Centers for Medicare & Medicaid Services (CMS); 2017. Available from the QualityNet Web site .

NQMC Status

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Copyright Statement

Production

Source(s)

Yale New Haven Health Services Corporation (YNHHSC), Center for Outcomes Research and Evaluation (CORE). 2017 procedure-specific measure updates and specifications report: hospital-level 30-day risk-standardized mortality measure. Baltimore (MD): Centers for Medicare & Medicaid Services (CMS); 2017 Mar. 46 p. [9 references]

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